Atlantic Richfield Company

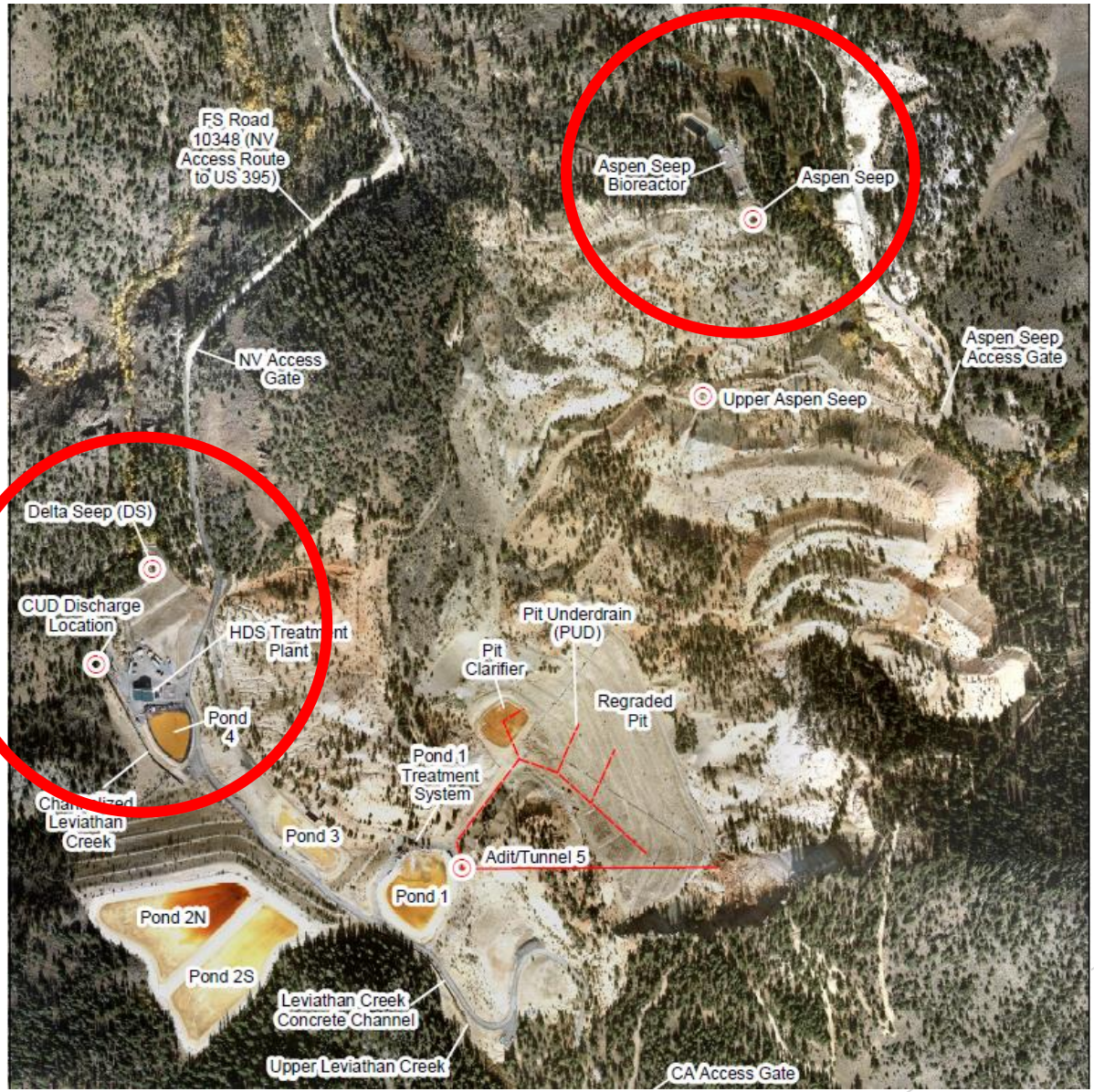
# Treatment System Operation Summary

## Annual Technical Summary Meeting

Leviathan Mine Site

January 26, 2017

# Leviathan Mine Site



# Field Operating Season

Provide safe access as soon as possible

- April 4, 2016 – November 1, 2016
  - Site Access including Mobilization and Winterization

**HDS/Pond 4**

- May 16, 2016 – October 13, 2016
  - Capture at Channel Underdrain (CUD) and Delta Seep (DS)

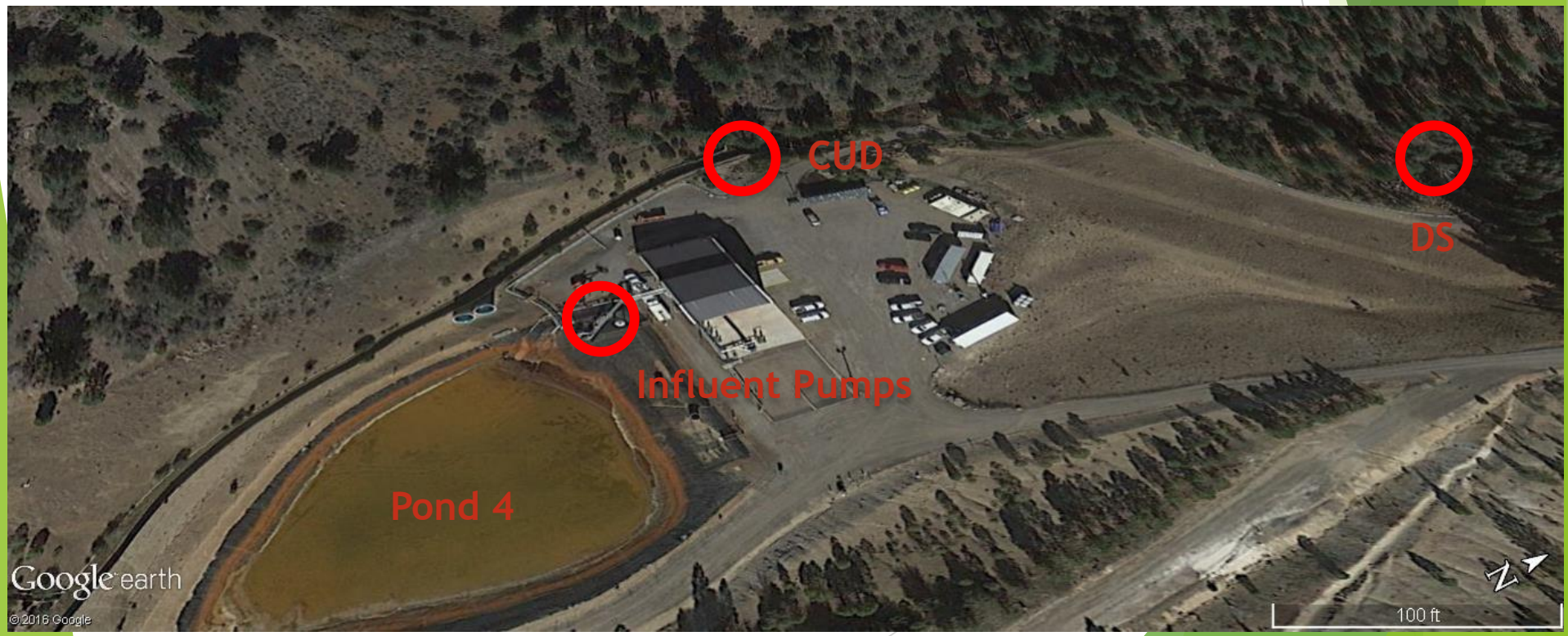
**ASB**

- Operated all 2016

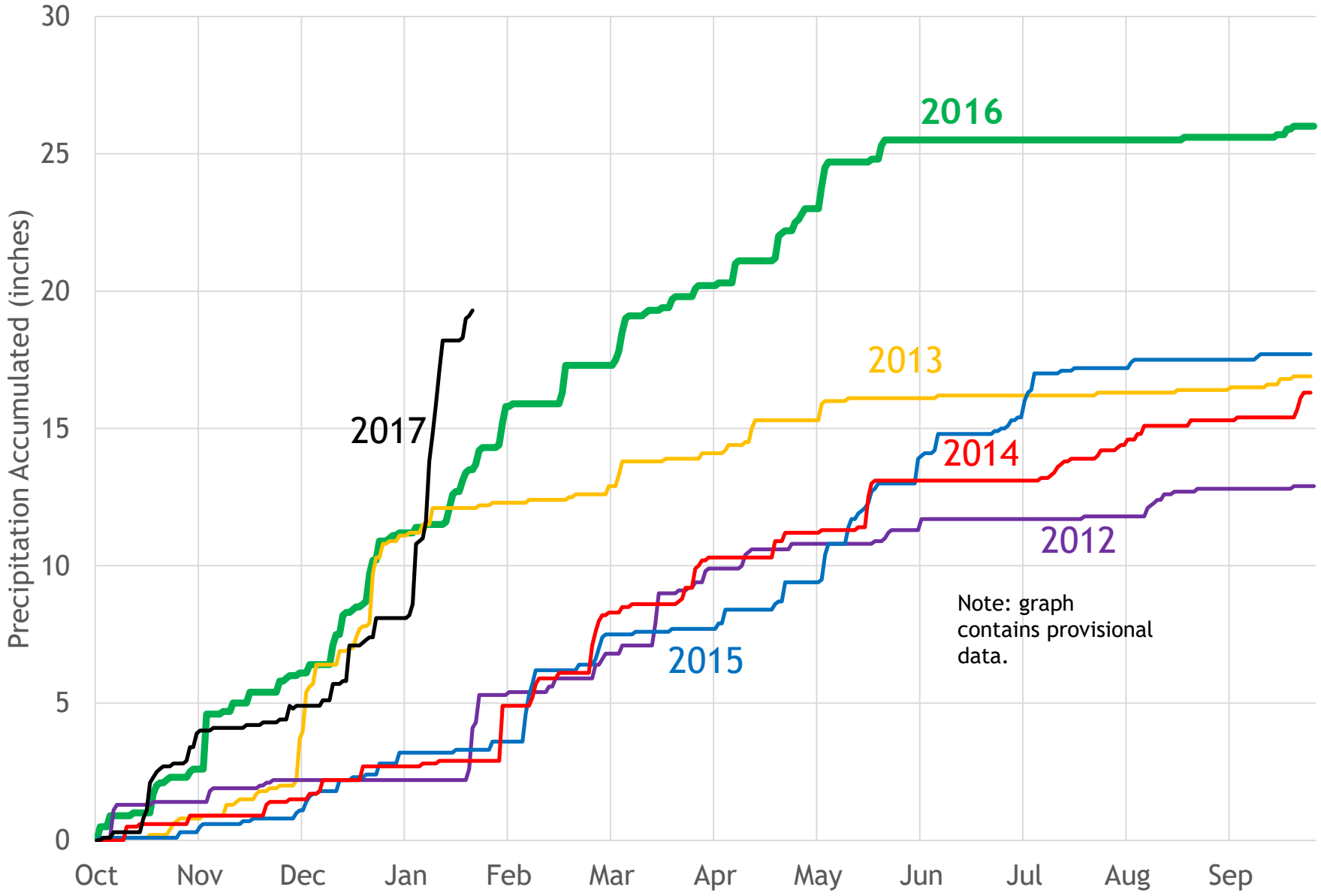
# HDS Treatment System – Background

HDS System Components

- Capture and Conveyance
  - 2 capture locations
    - Channel Underdrain (CUD)
    - Delta Seep (DS)
  - Pond 4 (Pre-treatment Water Storage)
  - Influent Pumps

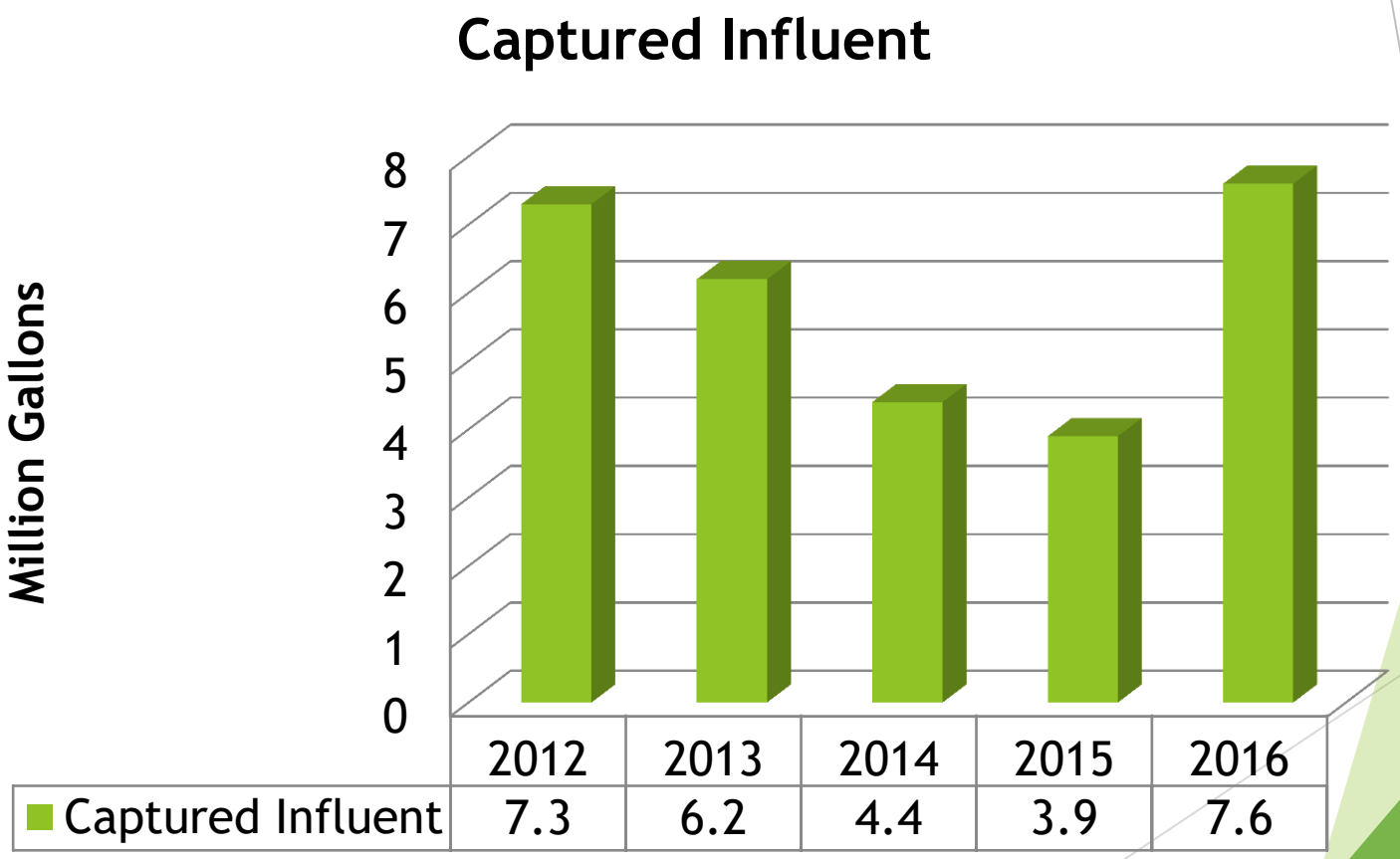


# SNOTEL - Monitor Pass

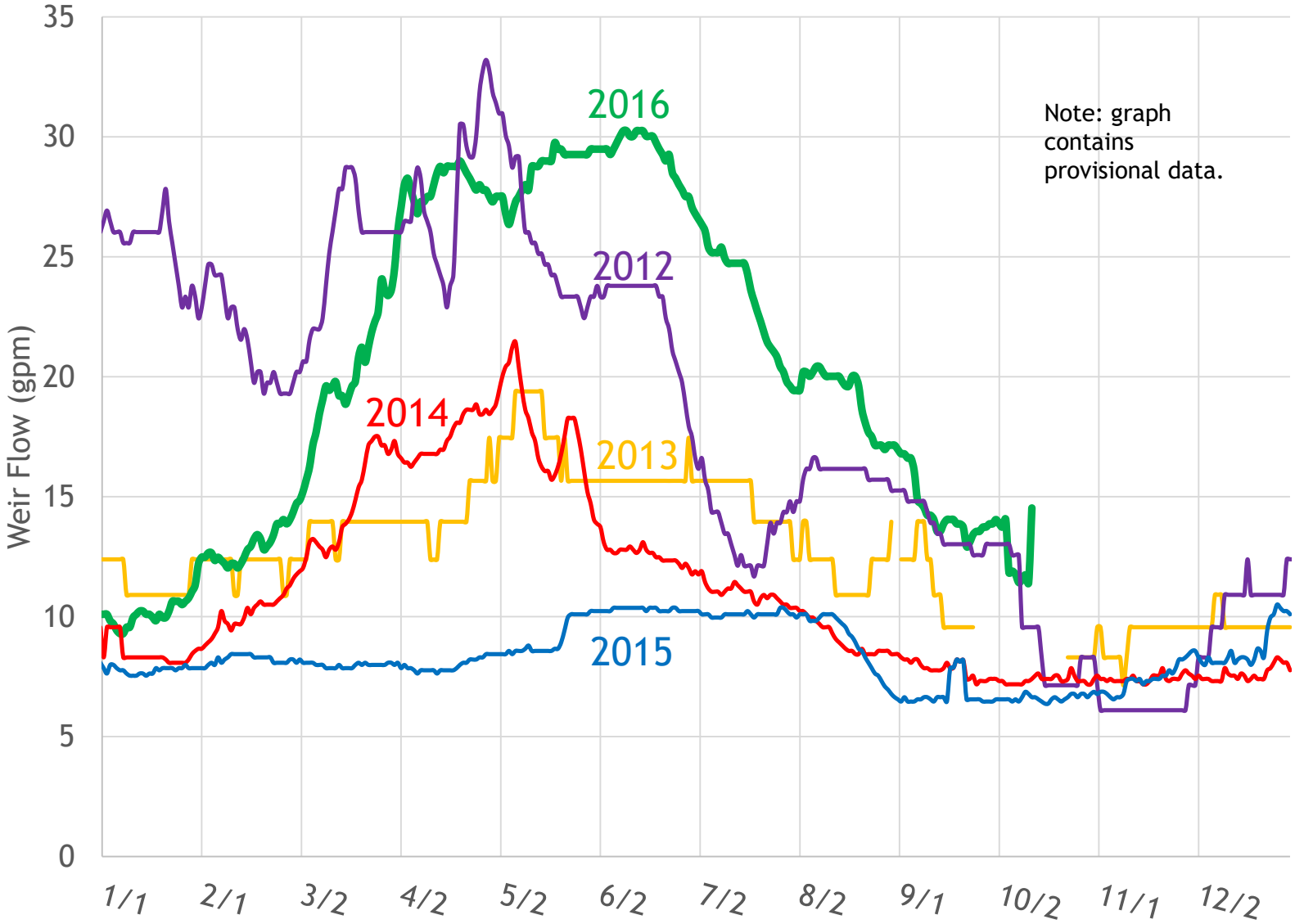


# HDS Treatment System

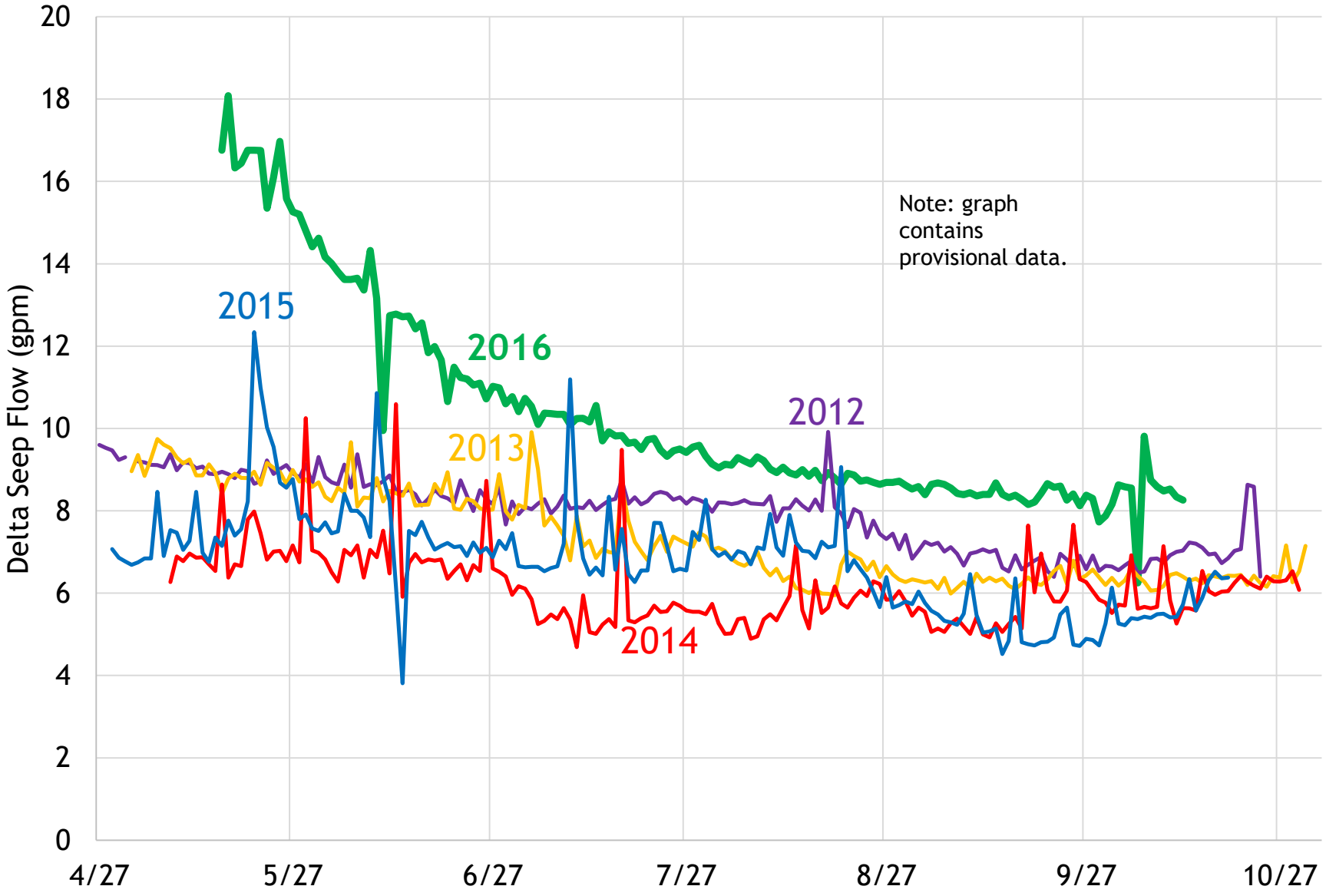
- All discharge to Leviathan Creek met discharge criteria



# Channel Underdrain Historic Flow



# Delta Seep Historic Flow



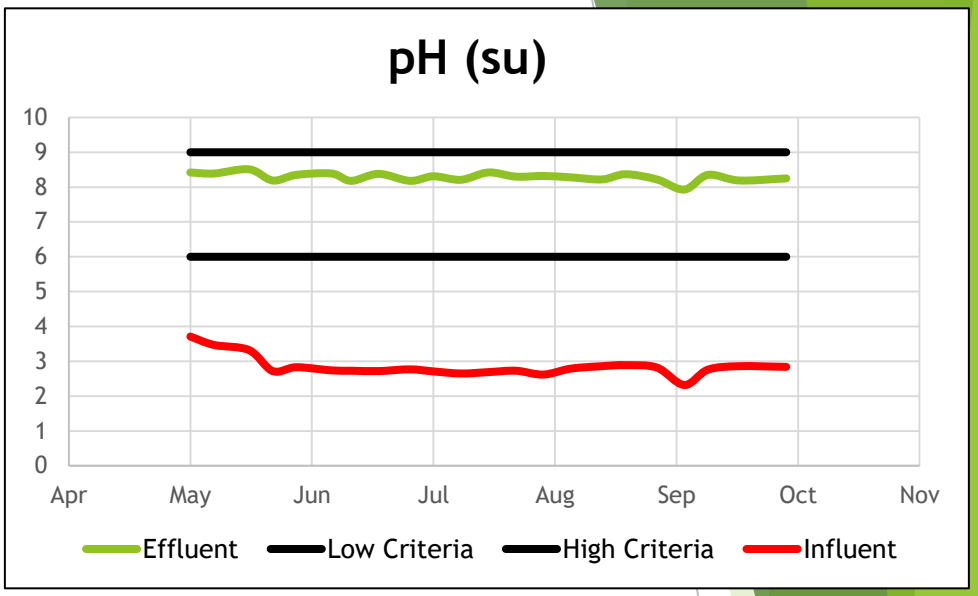
# HDS Treatment System 2016 Optimization

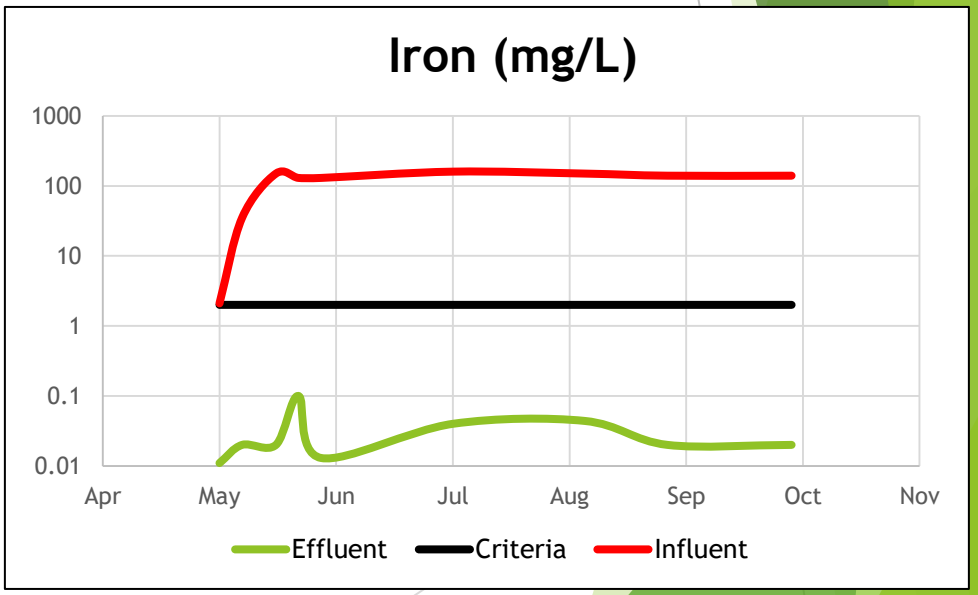
- Installed intelligent VFDs at the CUD, DS, and DST collection tank control panels
- Installed stainless steel pipe at CUD, DS, and DST collection tanks
- Prepared for treatment of water from upper ponds

# 2016 HDS Effluent

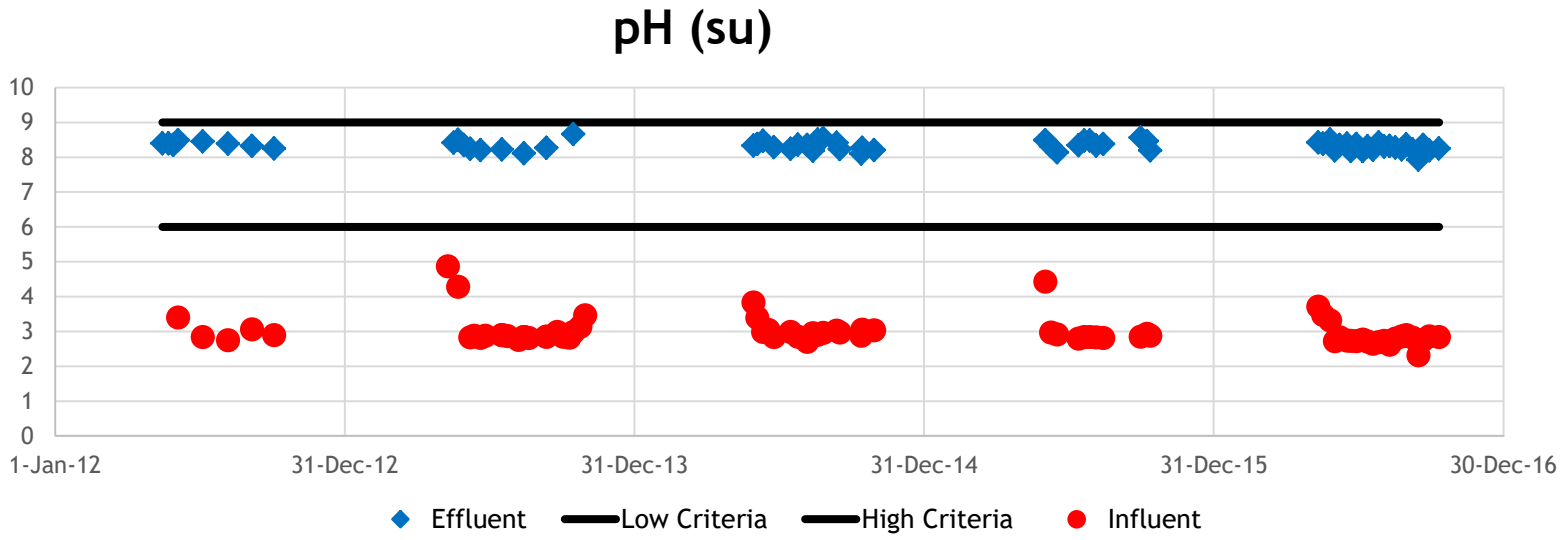
| Analyte | Max | MRAM Criteria |
|---|---|---|
| Aluminum | 1.6 | 4 |
| Arsenic | 0.0025 | 0.34 |
| Cadmium | < 0.0010 | 0.009 |
| Chromium | < 0.0020 | 0.97 |
| Copper | 0.0023 | 0.026 |
| Iron | 0.013 J | 2 |
| Lead | < 0.0010 | 0.136 |
| Nickel | 0.03 | 0.84 |
| Zinc | 0.0067 J | 0.21 |

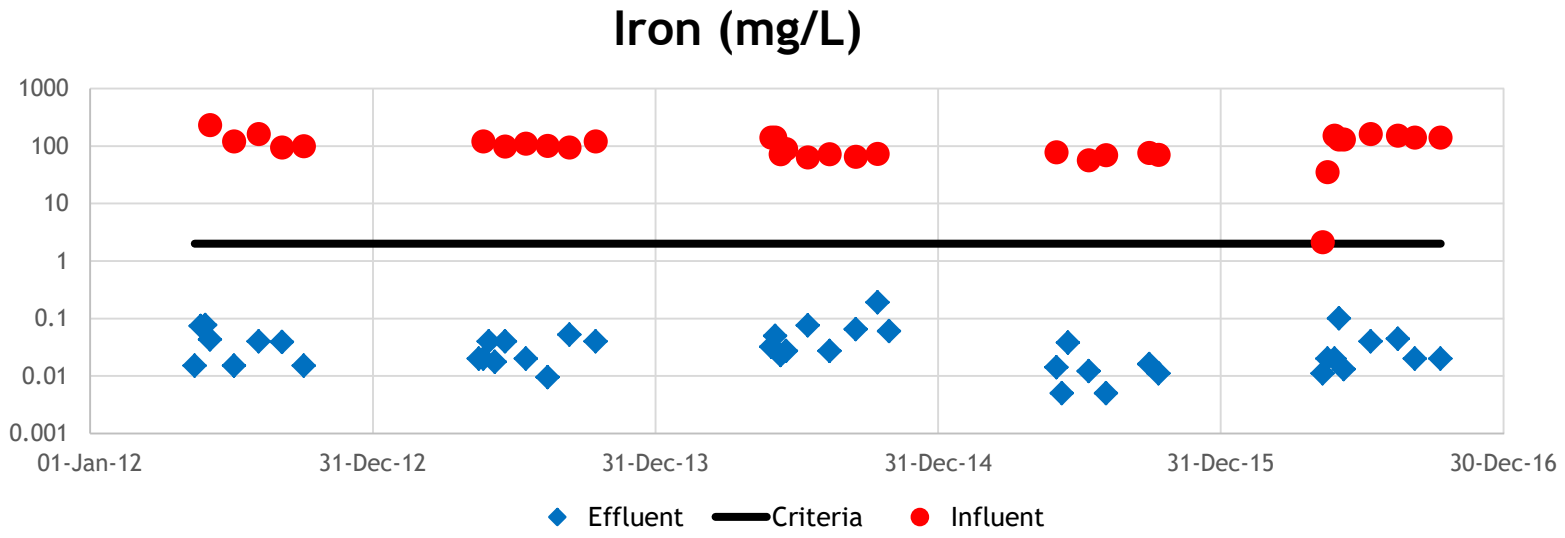
Note: Criteria is Discharge Daily Grab. All analytes are dissolved and in mg/L except pH, which is su



# HDS Treatment System
## pH and Iron – 5 years



# HDS Effluent Metal Reduction

| HDS Metal Removal | | | | | | |
|---|---|---|---|---|---|---|
| Year | Metal Removal (%) | | | | | Compliant Effluent Samples |
| | Al | Cu | Fe | Ni | Zn | |
| 2012 | 98.41 | 72.01 | 99.97 | 98.39 | 96.58 | 8/8 |
| 2013 | 98.36 | 87.06 | 99.97 | 98.45 | 95.54 | 9/9 |
| 2014 | 98.82 | 90.72 | 99.92 | 98.31 | 93.65 | 8/8 |
| 2015 | 98.49 | 86.76 | 99.98 | 98.34 | 93.27 | 6/6 |
| 2016 | 97.95 | 99.57 | 99.97 | 98.66 | 98.48 | 9/9 |

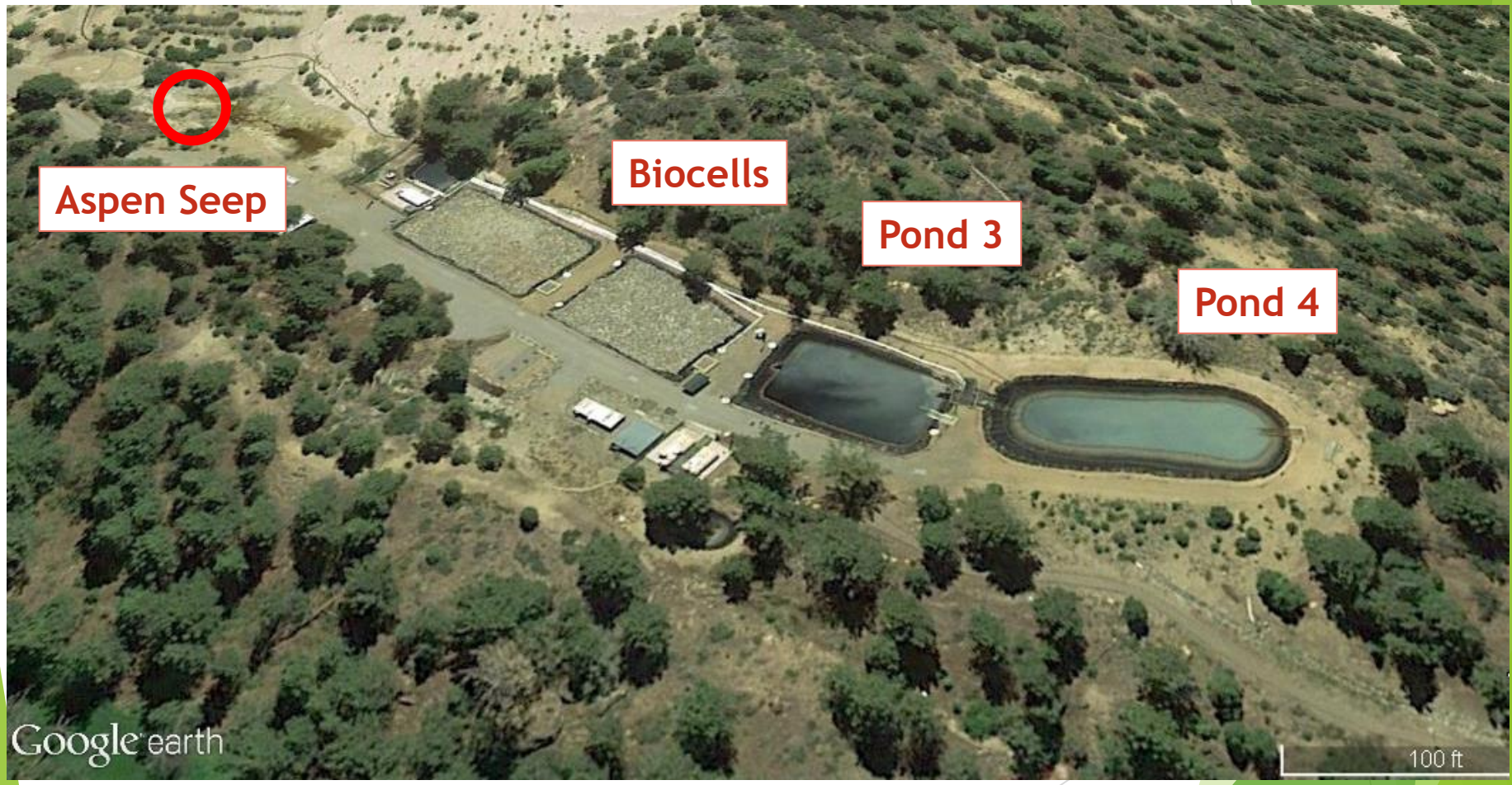
# Leviathan Site Treatment Achievements

| PWTS (1999-2016), Pond 4 (2001-2016) & ASB (2005-2016) Achievements | | |
|---|---|---|
| Water Treated | 245,152,000 | Gallons |
| Al Removed | 448,943 | Pounds |
| As Removed | 5,767 | Pounds |
| Fe Removed | 812,140 | Pounds |
| Ni Removed | 6,771 | Pounds |

Notes:

1. Removal volumes are calculated from yearly averages.
2. LRWQCB provided PWTS data.

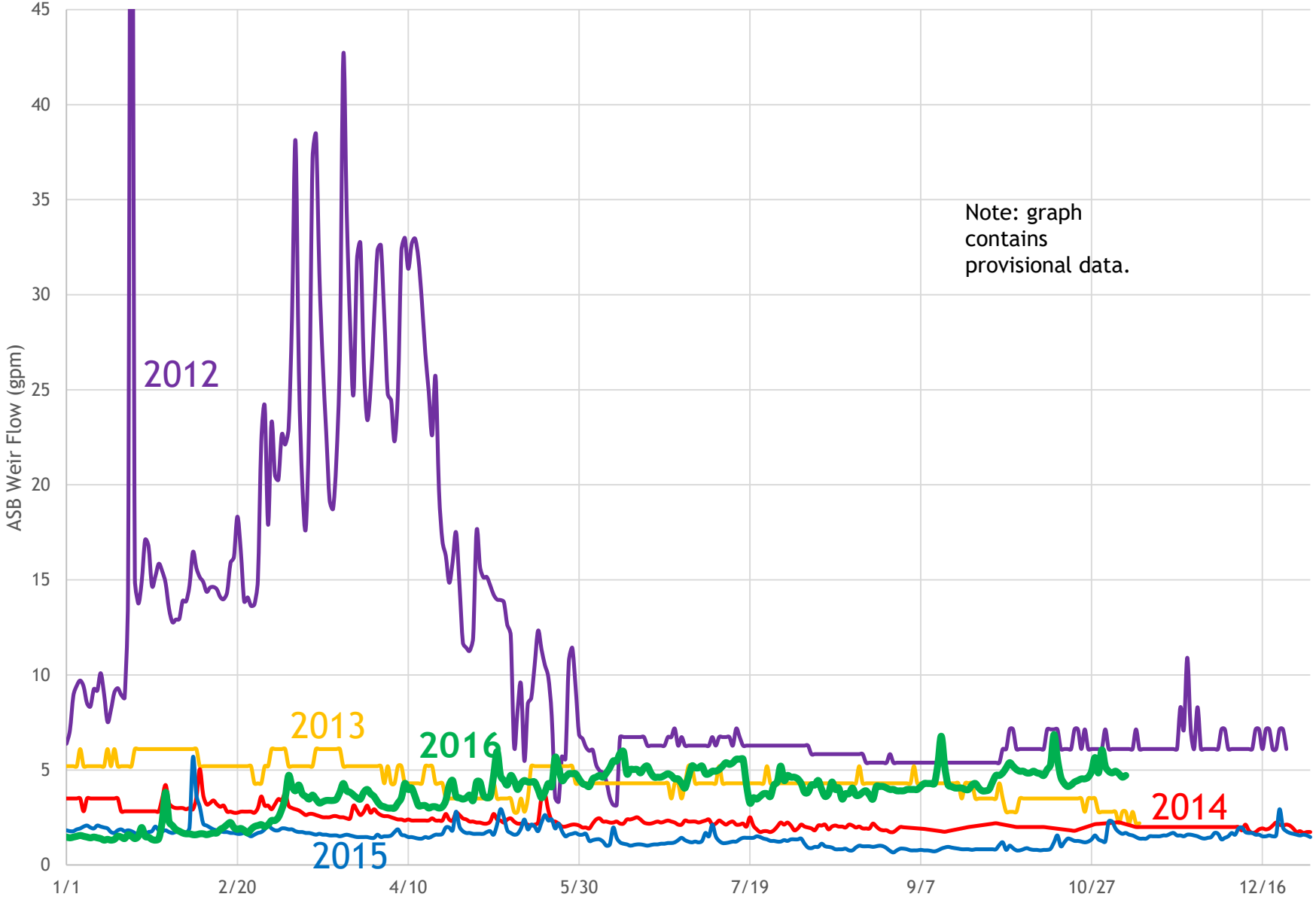
# ASB Treatment System



# ASB Treatment System – Operations

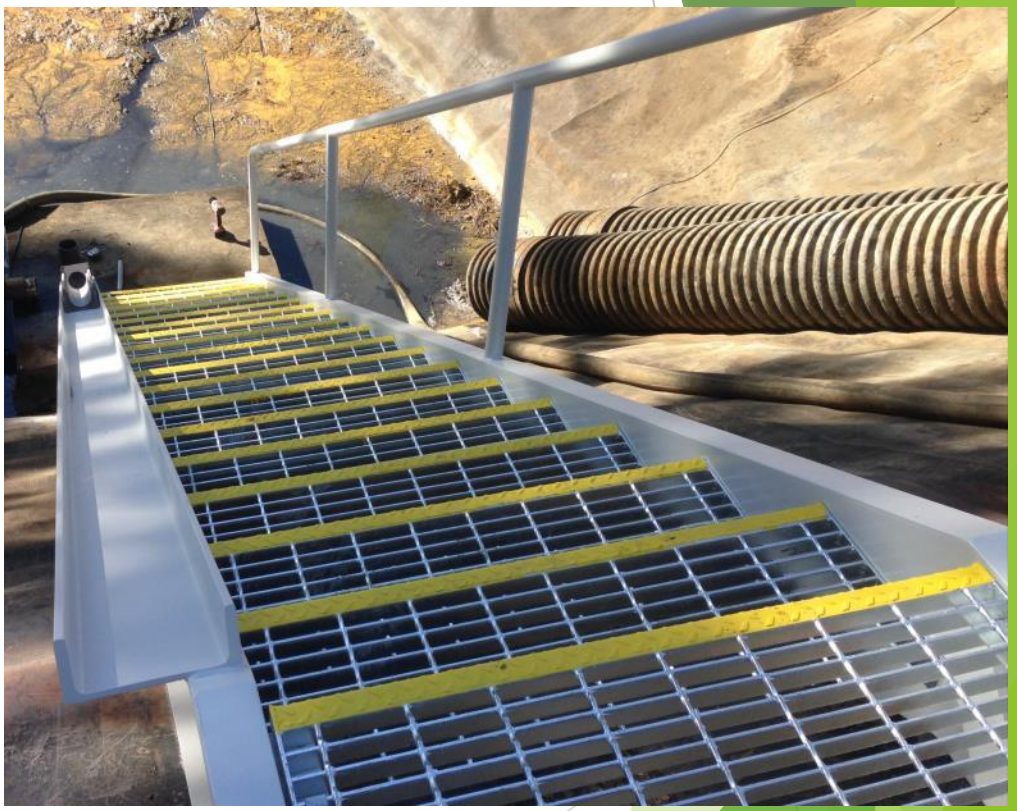
- Year-round Operation
- LAS Operations October 1 – May 31
  - Monthly visits for system O&M, cold weather system upsets, and compliance sampling
  - Specialized training for Winter Access
  - Detailed planning, preparation, and coordination
- ARWS Operations  June 1 – September 30
  - Performed system O&M and improvements
  - Monthly compliance sampling
  - Solids management

# ASB Influent Historic Flow Rates



# ASB Treatment System 2016 Optimization

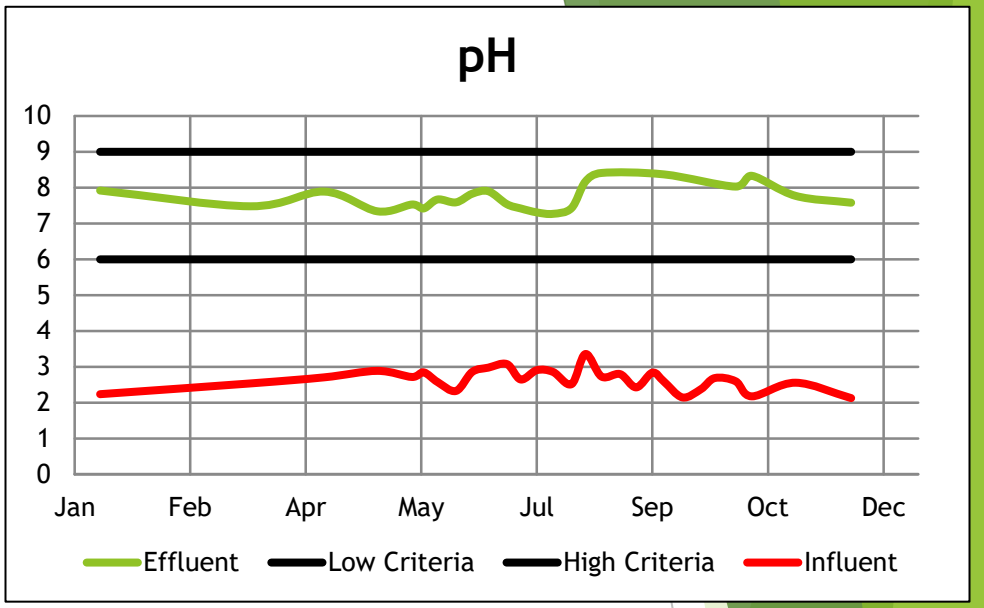
- Installed new hydrogen detector in the battery room
- Updated programming for ethanol batch dosing for low flow situations
- Maintained a portion of the Aspen Seep Collection Area

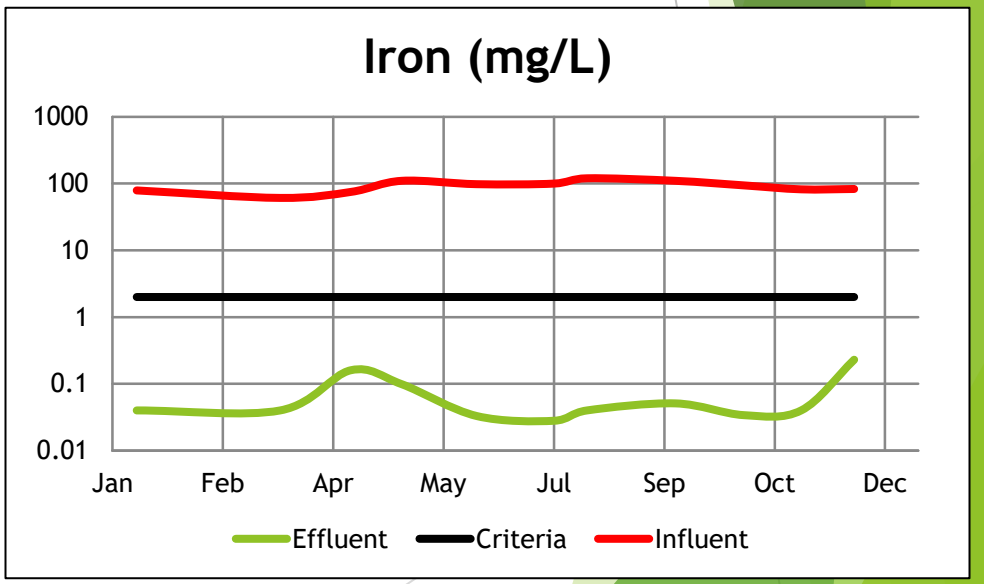


# 2016 ASB Effluent

| Analyte | Max | MRAM Criteria |
|---|---|---|
| Aluminum | 0.450 | 4 |
| Arsenic | 0.0014 | 0.34 |
| Cadmium | < 0.0050 | 0.009 |
| Chromium | < 0.010 | 0.97 |
| Copper | 0.0093 J | 0.026 |
| Iron | 0.230 | 2 |
| Lead | < 0.0050 | 0.136 |
| Nickel | 0.071 | 0.84 |
| Zinc | 0.031 | 0.21 |

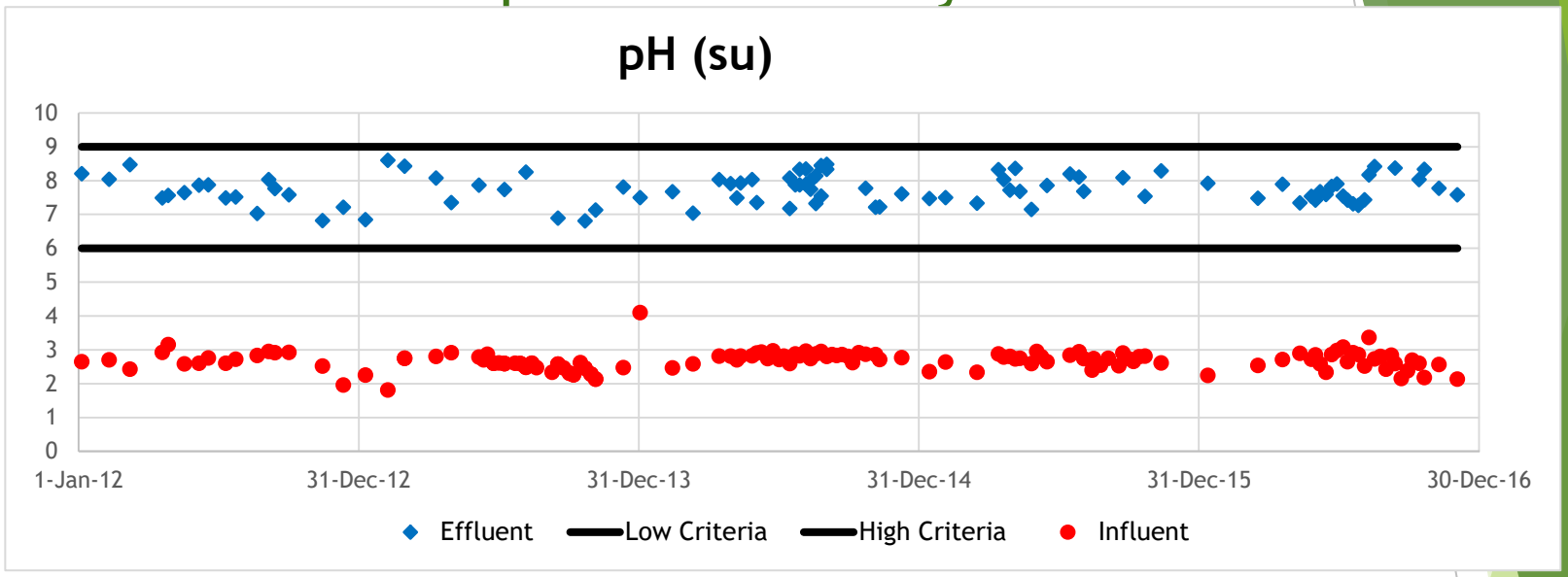
Note: Criteria is Discharge Daily Grab. All analytes are dissolved and in mg/L except pH, which is standard units (su)

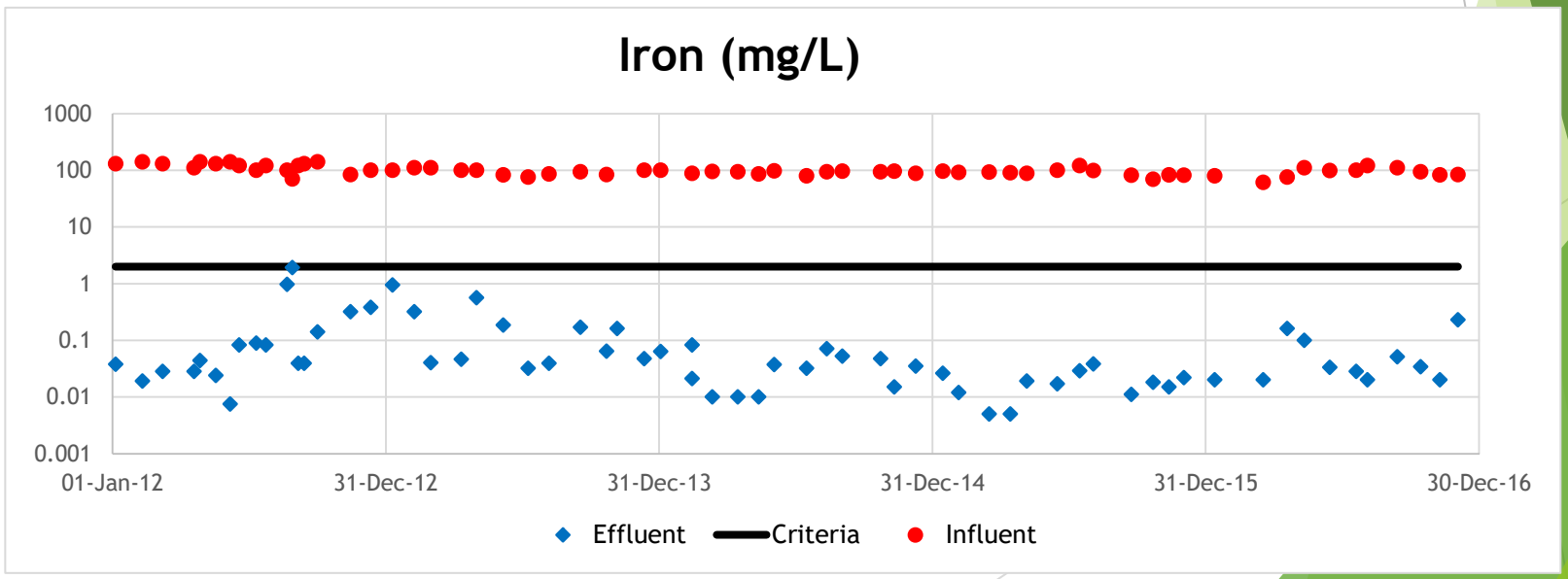


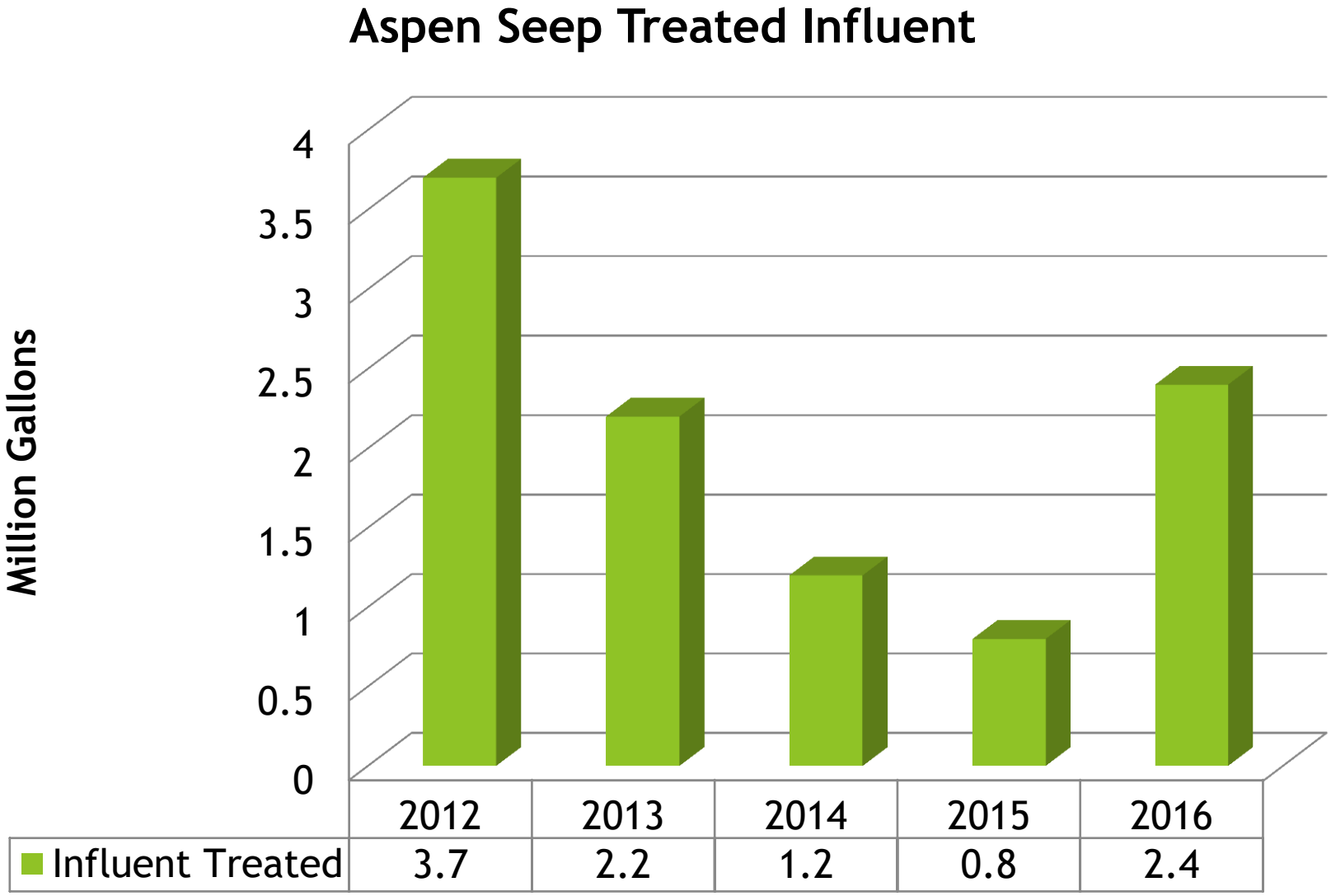
# ASB Treatment System

## pH and Iron – 5 years



# ASB Treatment System – Performance



# ASB Treatment System – Metal Removal

| ASB Metal Removal | | | | | | |
|---|---|---|---|---|---|---|
| Year | Metal Removal (%) | | | | | Compliant Effluent Samples |
| | Al | Cu | Fe | Ni | Zn | |
| 2012 | 99.65 | 99.78 | 99.79 | 95.92 | 98.40 | 17/17 |
| 2013 | 99.51 | 99.74 | 99.73 | 95.39 | 98.05 | 12/12 |
| 2014 | 99.68 | 99.75 | 99.96 | 96.58 | 98.04 | 12/12 |
| 2015 | 99.51 | 99.68 | 99.98 | 97.11 | 98.63 | 12/12 |
| 2016 | 99.54 | 99.60 | 99.93 | 93.30 | 96.64 | 11/11 |

# Questions?